

DOCUMENT RESUME

ED 418 279

CE 076 205

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TITLE Information Technology for Workplace Communication.
Workspace 21: The Ecology of New Ways of Working.
INSTITUTION State Univ. of New York, Ithaca. Coll. of Human Ecology at
Cornell Univ.
PUB DATE 1995-00-00
NOTE 62p.
AVAILABLE FROM International Workplace Studies Program, E-213 MVR Hall,
Cornell University, Ithaca, NY 14853 (\$20).
PUB TYPE Reports - Research (143)
EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Adult Education; *Business Communication; *Computer Mediated
Communication; Information Networks; *Information
Technology; Online Systems; *Organizational Change;
Organizational Development; *Teleconferencing; *Telephone
Communications Systems; Work Environment
IDENTIFIERS *Voice Mail

ABSTRACT

A study was undertaken to understand the role of electronic communication technologies (ECTs) in maintaining work-related communication. The study site was Sun Microsystems, a company at the high end of the curve in terms of its commitment to and employees' experience with ECTs. An electronic focus group (n=40, 4% response) and an e-mail survey with 396 responses (15% response) were used for data collection. No significant differences were found in use of or response to ECTs as a function of age, gender, or years in the company. Most employees used ECTs for the vast majority of their workplace communication needs, but the value of ECTs was limited for certain types of communications, such as discussions on complex and sensitive issues. They were insufficient for team building, consensus building, and conflict resolution. Most agreed that relying on ECTs for communication increased the likelihood of miscommunications and loss of privacy. Respondents saw ECTs as a less immediate form of communication and this became more true with the constant increase in the number of messages people were trying to deal with. Group work could sometimes be limited by ECTs, depending upon the group's size and expertise in communicating electronically. Some just felt the need for face-to-face communication. At the same time, many respondents reported ECTs, especially e-mail, helped them meet new people at Sun and develop and maintain social relationships. (Appendixes contain 28 references and the survey instrument.) (YLB)

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Workscape 21



The Ecology of New Ways of Working

Information Technology for Workplace Communication

Franklin Becker
Carolyn M. Tennesen
David Young

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Foreword

The International Workplace Studies Program is a research program based at Cornell University in Ithaca, New York. The program is supported by a consortium of private and public sector organizations in the United States, the United Kingdom, Europe, and Japan, and was launched in 1989. The IWSP mission is to generate research-based information related to the planning, design, and management of facilities that contribute to the development of more competitive and effective organizations.

Acknowledgments

The authors wish to express their appreciation to Kathryn Schmidt, who coordinated the research at several sites in the Silicon Valley, and the many cooperative subjects whose participation made this study possible.

Executive Summary

Businesses are undergoing tremendous changes in the ways in which people are working. Employees are working away from the traditional office, they are working under different schedules, and their work requires new ways of communicating. New technologies are being developed which support the need for new ways to communicate. The technologies, such as the fax machine, cordless telephones, voice and e-mail, beepers and pagers, conference call capabilities, and videoconferencing have been developed to enable today's more mobile worker—as well as employees who work in the same place but regularly communicate with colleagues in the same company located in different buildings, sites, and cities—to support various forms of remote communication. Collectively, these information technologies are referred to in this report as Electronic Communication Technologies (ECTs).

With employees becoming more mobile and new forms of technology being developed to support their evolving communication needs, it becomes increasingly important to understand what the effects of electronic communication are on the employees and the organization. The purpose of this study was to understand the role of ECTs in maintaining work-related communication.

Research Questions

- Are certain groups of people, such as women or older employees, less comfortable with the use of ECTs?
- How are ECTs used for effective workplace communication?
- What is the relationship between ECTs and specific tasks or project stages?
- How does the use of ECTs affect face-to-face communication?
- How does communication using ECTs affect employees' social relations within the organization?

The Site and Sample

Sun Microsystems was chosen as the study site because we wanted to examine a company that was at the high end of the curve in terms of its commitment to and employees' experience with ECTs. Looking at how leading-edge organizations are working provides the opportunity to examine real behavior and experience with a new way of working, rather than relying on people's best guess

about how a new workplace strategy or communication technology might work *were* they to experience it. Sun Microsystems has implemented a wide range of ECTs and employees have been communicating primarily electronically for quite some time. An electronic focus group and an e-mail survey were used for data collection.

Key Findings

ECTs and Types of Employees

No significant differences were found in use of or response to ECTs as a function of age, gender, or years in the company, with one exception. When giving feedback, employees with less than ten years of work experience were more likely to use ECTs than those with ten or more. This does suggest that older workers may feel less comfortable than younger ones in using ECTs for this particular form of communication.

ECTs and Types of Communication

- Most respondents used and preferred ECTs for the majority of their everyday workplace communications.
- Employees were comfortable asking for assistance using ECTs and felt that they were able to get technical and work-related feedback quickly using ECTs.
- ECTs were particularly well-suited for communications directed at large numbers of people as well as those that either did not need an answer or were not time sensitive.
- Sharing of specific information and coordination activities were especially well handled using ECTs.
- Employees particularly liked the asynchronous aspect of electronic communication, the opportunity to compose their thoughts ahead of time (as opposed to face-to-face communication), and the “paper trail” left when using ECTs.
- Most respondents felt that e-mail was the preferred method of communication for the middle stages of projects: technical and administrative communications as well as the project management components.

ECTs and Face-to-Face Communication

- Respondents were split as to whether they were more likely to offer feedback using ECTs or with a face-to-face meeting. Many felt that depending upon the type of feedback, there were times when face-to-face communication was more appropriate.
- Most agreed that complex discussions, personal or sensitive issues, and problem-resolution tasks were best handled face-to-face.
- A growing problem with the use of electronic communication has been message overload, resulting in long delays before getting a response if a response is received at all. For this reason, many preferred a face-to-face meeting, if possible, when their communication need was urgent.
- In reference to project stages, face-to-face communication was especially preferred (e-mail was especially disliked) for team building and brainstorming.
- Although ECTs were used for the majority of communications, they did not replace face-to-face contact. There were times when face-to-face meetings were considered necessary.
- When they did meet face-to-face, most employees reported that these meetings were more focused as a result of having communicated electronically.
- The majority of respondents did not feel that their use of ECTs had any effect on the amount of face-to-face contact they had.

ECTs and Social Contact

- Many respondents felt that ECTs and e-mail, in particular, were a great way to get to know others with similar interests.
- Sun has provided its employees with numerous methods of using e-mail to communicate on an ongoing basis with groups of others. Through these groups, employees reported being successful in meeting people, developing personal relationships, and engaging in formal and informal learning. They also found that ECTs were useful for maintaining social and business contacts.

- Rather than reducing or eliminating face-to-face contact, many employees reported that the use of ECTs in conjunction with face-to-face communication enabled them to maintain better contact with more people.

Implications for Integrated Workplace Strategies

Sun Microsystems has equipped its employees well with a range of information technology tools. The employees have embraced these tools and use them for a majority of their communication. The data from this small study suggest that when electronic communication tools are provided, and become part of the basic organizational culture, they can and are used effectively to support work-related and social communication that, in other organizations, is still done face-to-face or using paper-based media. Electronic communication does not, however, substitute for or reduce the need for or value of face-to-face communication. ECTs may make face-to-face communication more focused when it does occur, and it would appear to be used more judiciously, to support particular kinds of communication for which face-to-face is best suited. These data suggest that integrated workplace strategies that involve some form of remote work can be effectively supported by ECTs, as long as the remote work allows employees to come together face-to-face when the specific task or stage in a project warrants it.

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Introduction

Businesses are undergoing tremendous changes in the ways in which people are working. Employees are working away from the traditional office, they are working under different schedules, and their work requires new ways of communicating. New technologies are being developed which support the need for new ways to communicate. These technologies, such as the fax machine, cordless telephones, voice and e-mail, beepers and pagers, conference call capabilities, and videoconferencing have been developed to enable today's more mobile worker—as well as employees who work in the same place but regularly communicate with colleagues in the same company located in different buildings, sites, and cities—to support various forms of remote communication. Collectively, these information technologies are referred to in this report as Electronic Communication Technologies (ECTs).

With employees becoming more mobile and new forms of technology being developed to support their evolving communication needs, it becomes increasingly important to understand what the effects of electronic communication are on the employees and the organization. The purpose of this study was to understand the role of ECTs in maintaining work-related communication.

The importance of communication to the success of a business cannot be understated. It is the foundation on which all corporate activities are built. Businesses are not made up of individuals working in isolation. Work is organized into departments, sub-units, committees, task forces, etc., all of which depend on the sharing of information and coordination of activities. Whereas businesses fifty years ago conducted most of this kind of communication face-to-face or over the telephone, supplemented by written reports, letters, and memos, businesses today are adopting a variety of ECTs in order to meet these same needs. A major reason is that businesses have grown enormously in size and complexity, and more importantly, are likely to have employees working from many different locations, even within the same city or the same campus *on the same project or activity*. Adding to the complexities of this distributed workforce is the fact that many employees work in different locations over the course of the day, week, year or a project. As work patterns become both more distributed and more mobile, communication becomes ever more important and complex. It is this communication context that has driven the increasing reliance on electronic forms of communication.

Informal Communication and Communities-of-Practice

Another set of issues related to workers who communicate primarily using ECTs has to do with the ways in which these employees come to learn about their organization and its culture, their co-workers, and how to perform their jobs. Brown and Duguid (1991) argue that the way people actually work differs fundamentally from the ways organizations describe that work in manuals, training programs, organizational charts, and job descriptions. They state that “conventional descriptions of jobs mask not only the ways people work, but also significant learning and innovation generated in the informal communities-of-practice in which they work” (p. 40). It is through these informal communities that employees learn from their peers how to navigate the corporate bureaucracy, who to contact to get the most accurate technical information, what the undocumented “tricks” to making a program work are, how to best contact different types of clients, how to respond to certain kinds of queries, and so on.

Learning, according to Lave and Wenger’s (1990) concept of legitimate peripheral participation, involves becoming an “insider”. This approach suggests that it is not the abstract knowledge of the work that is needed for learning, but participation in the practices and communities in which that knowledge takes place. If ECTs are integral to carrying out one’s job, it becomes important to know whether they can serve as the medium for this kind of informal learning.

Much of this informal learning is assumed to occur in face-to-face contacts, at lunch, over coffee, or traveling to client sites. Becker (1990) argues that the physical arrangement of the office space can influence creative types of communication more than the formal organizational structure. A number of researchers have suggested that informal organizational communication can be the key to problem solving and successful organizational development (Allen, 1977; Becker, 1990). Allen (1977) notes that the need for knowledge-enhancing communication is a function of the rate at which the knowledge is changing. The more dynamic a technology, the more communication between colleagues is needed to keep up with new developments. In most organizations today, of almost any sort, the rate of new developments in any field is enormous. New ways of working, including remote working that relies on electronic communication, that undermine the opportunities for this kind of work-related learning could, over the long run, seriously undermine organizational learning and with it organizational effectiveness.

Businesses have adopted modern forms of communication technology in hopes of increasing efficiency and productivity. However, the range of potential effects of ECTs on the organization, and on informal communication and learning patterns themselves, is not fully understood. These technologies can change how people spend their time as well as what and who they know and how they access and process information. They also change how people work together, and in the

increasing number of organizations where teamwork and collaboration is considered essential to long term survival, this is not a trivial issue. Business managers must be concerned with how ECTs are transforming the workplace and what they can do to preserve the kind of informal learning upon which the organization depends.

The purpose of this study was to understand the role of ECTs in maintaining work-related communication. The intent was to discover what the limits or boundaries to the use of electronic communication technologies are and how their use transforms the employees and the workplace. Sun Microsystems, located in the Silicon Valley in California, provided the field site for this study. A full discussion of Sun and the way people work is discussed below (see The Research Site).

Selected Review of the Research Literature

There are a range of issues related to the use of electronic communication technologies. A number of these have been addressed in the research literature. Key findings are outlined below. For employees using ECTs as their primary mode of communication, it would be helpful to have a better understanding of the following topic areas:

- Face-to-face versus electronic communication.
- Face-to-face versus electronic communication for meetings/project stages.
- Demographic differences and ECTs.
- ECTs and social contact.
- ECTs and sense of corporate identity/belonging.
- ECTs and task performance.

Face-to-Face Versus Electronic Communication

Communication media vary in their “richness” or the extent that they differ in their capacities to resolve ambiguity (Daft and Lengel, 1984). Face-to-face communication is the “richest” form because it provides instant feedback, involves the transmission of multiple cues (body language, voice tone, inflection, interpretation), uses natural language (not numbers), and is directly personal. Written paper-based media are at the opposite end of the spectrum.

Characteristics of Face-to-Face Communication

Benefits

- Although strangers felt more embarrassed meeting one another face-to-face, they ended up liking each other better than in a computer-mediated condition (Kiesler, Siegel & McGuire, 1984).
- The richness of face-to-face communication including the availability of immediate feedback and the ability to detect cues as to others’ level of understanding might make it easier for people to work on complicated, in-depth tasks. Hollingshead, McGrath and O’Connor (1993) found

that face-to-face groups performed better on intellectual and negotiation tasks than computer-mediated groups.

- Face-to-face conditions appear better suited to bringing about attitude change (Adrianson & Hjelmquist, 1993; Croft, Stimpson, Ross, Bray & Breglio, 1969; Weimer, 1988). For example, Croft et al. (1969) exposed students to a live or videotaped persuasive argument. Those in the live condition showed significantly greater attitude change than those in the videotape condition.
- Some research suggests that face-to-face groups are more problem-focused than electronic groups. Kiesler et al. (1984) had business managers and university administrators work in groups on a problem in person or using the computer. Those in the face-to-face condition were more effective in considering all the issues and coordinating their discussion.
- Another study found that groups working in a face-to-face condition had less difficulty coordinating their work than those in a computer-mediated condition, and the difference became more pronounced as their projects neared an end (Galegher & Kraut, 1990). Additionally, those in the face-to-face group were more satisfied with their work products, were more committed to their work partners, and felt more intellectual benefit from working with others than did those meeting electronically.
- Greater problem-focus and better work coordination might help explain why other researchers have found that face-to-face groups come to agreement faster and easier than those communicating electronically (even taking into account the technical difficulties of communicating electronically) (Kiesler et al., 1984; Olaniran, 1991; Sproull & Kiesler, 1991; Weimer, 1988). In fact, in one study, the more experienced the users were in a computer-mediated group, the greater difficulty they had in reaching consensus (Adrianson & Hjelmquist, 1993).

Drawbacks

- There also appear to be drawbacks related to the greater richness provided by face-to-face conditions. Higher status people in organizations as well as males tend to dominate and control face-to-face discussions (Sproull & Kiesler, 1991; Zimmerman & West, 1975), while participation in computer-mediated groups is more equal (Kiesler et al., 1984; Sproull & Kiesler, 1991).

Characteristics of Electronic Communication

Potential Benefits

- Groups working electronically are more likely to make riskier decisions (Sproull & Kiesler, 1991) and produce more ideas on brainstorming tasks (Hollingshead et al., 1993; Olaniran, 1991; Valacich, George, Nunamaker & Vogel, 1994).
- The use of e-mail appears to make it easier for employees to communicate up the hierarchy (Sproull & Kiesler, 1986).

Drawbacks

- Computerized communication has been shown to result in greater degrees of uninhibited behavior (Kiesler et al., 1984) with rude and impulsive behaviors more likely using ECTs, particularly under conditions of anonymity (Sproull & Kiesler, 1991).

Technical Hurdles of ECT Communication

- There may be some technological hurdles to overcome when communicating electronically that would not exist in face-to-face conditions. One study found that computer-mediated groups as opposed to face-to-face groups needed extra time to adjust to the new technology, performed less well in times of change, and had initial negative reactions to the technology (Hollingshead et al., 1993).

In summary, the literature suggests that face-to-face communication is successful for producing attitude change, coordinating, and coming to agreement. Electronic communication results in more equal participation, more uninhibited behavior, and groups that are more willing to take risks.

Face-to-Face Versus Electronic Communication for Meetings/Project Stages

When does it make sense to meet face-to-face and when is it more appropriate to meet or continue to work electronically? Major influences on which media makes most sense include the sensitivity of the information, whether the purpose is to share information or make a decision, and the stage in the project process.

- Face-to-face communication also has been found to be more effective for intellectual and negotiation tasks. Sproull and Kiesler (1991) suggest that face-to-face communication is better when the goal is to generate commitment to a course of action.
- In a study by Galegher and Kraut (1990), electronic groups had more trouble initiating, planning and coordinating their work, particularly at the beginning and end stages of a project. They suggest that computer-mediated communications will be more valuable for coordinating already existing collaborative projects than for starting new ones.
- Other researchers recognize the importance of the particular participants involved in the project and the amount of time they have worked together (Galegher & Kraut, 1990; Zack, 1991). They also suggest that computer-mediated communications will be more valuable once the members of a project group have gotten to know one another and work together.

Periodic face-to-face meetings in addition to ongoing electronic communication appear to be an ideal arrangement. Sproull and Kiesler (1991) cite the example of product designers in one organization who met electronically and still held face-to-face review meetings. They suggest that “face-to-face meetings are now more focused and rigorous because participants exchange information electronically before the meetings to clear up confusions, prune away distractions, and identify the key issues” (p. 74).

Demographic Differences and ECTs

A commonly held belief is that older people and women are less comfortable and adept with the use of computers. Young people are considered part of the computer generation and, therefore, less likely to exhibit computer anxiety.

Massoud (1991) found that men were less anxious about using computers, like them and had more confidence using them, and had greater computer knowledge than females. No age effects were discovered.

ECTs and Social Contact

While the focus of this research was primarily on the influence of ECTs on work-related communication, the ways in which ECTs affect social communication are also of interest. For many employees, the opportunity to socialize with co-workers is one of the most rewarding and satisfying aspects of work. The extent to which ECTs provide a viable medium for forming and

maintaining social connections with co-workers whom one does not see every day is thus an important issue.

- Numerous researchers have found that people who have participated in telework or mobile work programs begin to feel isolated in both a social and professional sense. Huws, Korte, and Robinson (1990) state that the higher the proportion of their working time teleworkers spend at home, the more dissatisfied they are with their contacts with others in similar work. “More than half of the teleworkers spending nearly all their working time at home mentioned the lack of social contacts as a disadvantage of telework” (p. 62). Other research shows that if people start to do teleworking more than 50 to 60% of the time, they no longer feel part of the organization (de Jonge, 1992).
- The majority of employees in a mobility program at IBM who were able to work in a variety of locations that did not include their former office rated the lack of social interaction as the aspect they liked least about the program (Callentine, 1995). In addition, a number of employees cited the lack of professional interaction as the aspect they liked least.
- Upon a review of the literature, Perrolle (1991) claims that computer-mediated communication reduces the social solidarity in existing social groups.
- When communicating exclusively using ECTs, such as in a *full-time* teleworking environment, Martino and Wirth (1990) suggest that workers may become isolated, have elevated levels of stress, and reduced morale.

ECTs and Sense of Corporate Identity/Belonging

While working in a mobile or remote manner may reduce opportunities for face-to-face contact with co-workers, there is some evidence that electronic communication can provide a “window on the corporation”.

- Sproull and Kiesler (1991), based on their research on a Fortune 500 firm, state that receiving e-mail:

can affect employees’ attitudes toward their organization by increasing their informational and emotional connections to other employees. This can be particularly true for peripheral employees who participate in large electronic distribution lists, bulletin boards, or conferences. (p. 81)

- Communicating using e-mail can also increase employees' connectedness. One study found that peripheral people who communicated electronically not only experienced significantly more involvement in the work of the group and got more satisfaction with its outcomes than those in a standard task force, but also felt that they formed significantly more lasting social ties with others in the organization (Bikson & Eveland, 1988).
- In another study it was found that use of electronic mail increased commitment to one's employer among those who otherwise might feel somewhat peripheral in an organization (Huff, Sproull & Kiesler, 1989).
- Huff et al. (1989) found the amount of electronic mail a person sent best predicted commitment.
- Individuals' mental health status has been found to be positively associated with the number of groups they belong to or social roles they hold (Thoits, 1983).

It seems likely that this would also hold true for the number of electronic groups a person belongs to. Thus, by communicating with co-workers through a variety of electronic groups, people might achieve both mental health gains and become better integrated into the organization's communities-of-practice.

ECTs and Task Performance

Our understanding of the specific types of tasks that work well using ECTs is much more limited than what we know about some other aspects of electronic communication. As Olaniran (1991) states, much of the research into computer-mediated communication is inconsistent. This is likely to be an effect of the specific systems, methodologies, and tasks used in researching this type of communication.

- Hollingshead et al. (1993) suggest that the relationship between technology and task performance may be dependent on experience with the technology and group membership rather than with the type of task.
- Bird-Westerfield (1990) and Zack (1991) conclude that choice of a communication mode should be based upon the specific circumstances surrounding the task.

- Kahai (1993) states that it may not even be possible to find an effective ECT for a specific task. Rather, the effectiveness of an ECT will vary as different participants are assigned to a task and as participants work together over time.

Specific Research Questions

In summary, although a fair amount of research has been conducted examining how e-mail or other forms of electronic communication differ from face-to-face communication, we still do not understand which tasks can most benefit from being done electronically, nor how the use of ECTs can affect informal, work-related communication. This study focused on the following questions related to ECTs and work-related communication:

- Are certain groups of people less comfortable, such as women or older employees, with the use of ECTs?
- How are ECTs used for effective workplace communication?
- What is the relationship between ECTs and specific tasks or project stages?
- How does the use of ECTs affect face-to-face communication?
- How does communication using ECTs affect employees' social relations within the organization?

The Research Site

Sun Microsystems

Sun Microsystems is a multinational computer company based in the Silicon Valley in California. It is a dynamic, technologically advanced corporation with employees working and collaborating from a wide variety of locations in the Bay Area and worldwide. Employees of Sun have a range of electronic communication technologies available to them which they are expected to use in order to accomplish their collaborative work. Comments from Sun's employees help illustrate its high-tech culture.

I think [getting everyone involved in the decision processes] is a positive but more complicated environment than the more simplistic models of the past of the boss calling the shots and everyone then marching in lockstep. Most issues are in fact gray, are worthy of analysis and research, and gaining consensus is possible by an appropriate mix of energies spent communicating electronically to set the stage for face-to-face meetings and presentations.

It is a great place to work, especially if you like technology.

One of the unique experiences at Sun, because we have had Internet communication for so long is the ability to conduct dialogs with employees in other countries regularly. So not only is a typical product team made up of people from India, UK, Japan, Pakistan, China, Canada, and all over the US, a typical product launch and sales dialog takes place between Asia, US, and Europe all the time.

Numerous employees discussed the importance of electronic communication (particularly e-mail) to Sun's way of working. As suggested by the following, e-mail is used to disseminate a tremendous amount of information.

We have recently gone from publishing much of the material to the field to posting it on line as e-mail attachments. Between that and the daily dialog on areas of interest from all over the world, each participant feels that they are truly part of a global company.

E-mail is probably the primary forum for communication exchange within Sun, from company-wide distributions down to small project teams. E-mail is used to distribute schedules and plans, documents for review, meeting minutes, reports...an infinite number of uses. There is a saying at Sun, "Ignorance of e-mail is no excuse."

Another employee refers to all the people who are interconnected using e-mail, both formally and informally:

Though the organization is large, nearly anyone in the company is accessible through e-mail. In addition to management hierarchies, there are a great many informal networks of people who interact with each other electronically.

Another respondent refers to Sun as an “e-mail world” and says that “if you don’t use e-mail at Sun, you might as well not work here.” Finally, one employee discusses the dramatic increase in use of e-mail experienced since joining Sun:

I’ve gone through a bunch of culture shock over the past year since joining Sun. Sun (in my division) does EVERYTHING via e-mail.

Thus, Sun has for some time been heavily involved in the use of electronic communications. For many employees, ECTs are the primary form of communication. Because Sun is quite advanced in the use of e-mail communications rather than new to the ECT experience, it was felt that the comments and experience from Sun employees would be particularly useful in giving a picture of the role ECTs can play in workplace communications. As long-time users of ECTs, their experience is more likely to be indicative of what the future holds than that of a company that has just started using e-mail.

Methods

A contact from within Sun provided electronic mailing lists of those at one of the Silicon Valley sites who were regularly using ECTs. The mailing lists contained employees with a representative range of job types, work experience, age, and gender. Two methods were used to gather the data for the study: a focus group and a survey, both administered electronically.

Electronic Focus Group

One set of employees were contacted to participate in the focus group. They were initially contacted via e-mail with an introductory letter followed by a question for discussion. Two discussion questions were presented with one topic being discussed at a time. The first question dealt with the topic of how employees develop and maintain social links with people at Sun who work outside one's own group, either in other areas in one's building or in other Sun buildings. The second question asked about how electronic communication technologies are used for work-related communications. Respondents e-mailed their comments to the researchers. The responses were compiled (removing any identifying information) and sent back to those who had responded. Replies to each others' comments were encouraged and probes were used until the dialogue came to a halt.

Of the 1,000 employees on the focus group mailing list, just 40 responded, yielding a 4% response rate. Because the response was so limited, it is assumed that the focus group is a highly self-selected group of individuals who have a keen interest in ECTs. Consequently, their comments cannot be assumed to be representative of the entire group of employees. Respondents were primarily made up of 30- to 50-year-old males with 10 or more years of working experience in job types that were neither engineering nor professional services (see Table 1).

Table 1: Demographics of Focus Group and Survey Respondents.

Demographic Characteristic	Focus Group		Survey	
	Number	Percentage	Number	Percentage
Gender				
Male	29	73%	290	73%
Female	11	28%	106	27%
Age				
20-29	5	13%	67	17%
30-39	13	33%	195	49%
40-49	17	43%	99	25%
50+	5	13%	30	8%
Work Experience				
<5 years	2	5%	67	17%
5-9 years	3	8%	78	20%
10-14 years	15	38%	96	24%
15-19 years	4	10%	69	17%
20+ years	16	40%	86	22%
Job Category				
Hardware Engineer	0	0%	69	17%
Software Engineer	6	15%	189	48%
Professional Services	3	8%	42	11%
Other	31	78%	96	24%

Electronic Survey

A second set of employees made up the survey sample mailing list. Individuals on this list were asked to complete a sixteen item questionnaire using a survey software package used by Sun. Questions were developed by researchers of the International Workplace Studies Program and included both multiple choice and open-ended formats (see Appendix A). Twelve of the questions focused on ECT issues, asking for subjects' agreement with statements like, "I am able to get technical information I need quickly from co-workers at Sun using a combination of electronic communication technologies." The remaining questions asked for subjects' gender, age, years employed, and job type.

The survey was sent to 2,642 employees and completed by 396, yielding a 15% response rate. The demographics of the respondents very nearly matched the demographics of the entire mailing list. Hence, the sample was representative of the employee group making up the electronic mailing list. Respondents were mostly male software engineers between the ages of 30 and 39 (see Table 1).

Key Findings

The findings will be presented in order by research question topic area.

1. ECTs and types of employees.
2. ECTs and workplace communication.
3. ECTs and tasks/project stages.
4. ECTs and face-to-face communication.
5. ECTs and social relations.

1. ECTs and Types of Employees

No significant differences were found in use of or response to ECTs as a function of age, gender, or years in the company, with one exception. When giving feedback, employees with less than ten years of work experience were more likely to use ECTs than those with ten or more. This does suggest that older workers may feel less comfortable than younger ones in using ECTs for this particular form of communication.

2. ECTs and Workplace Communication

Using ECTs to Ask for Assistance

Very few respondents felt uncomfortable using ECTs to ask for assistance in their work. Eighty percent disagreed with the statement, “I feel uncomfortable using ECTs to ask for assistance on work I am doing,” including 58% who strongly disagreed (see Figure 1).

It is much simpler for me to get [assistance] on-line than to interrupt somebody's day to ask for information.

E-mail often works better than barging into someone's office. It's less intrusive and it allows the receiver more time to think.

Although most were very comfortable using ECTs for communication, at times there were frustrations related to the use of electronic communication including miscommunications, timeliness, or not knowing which tools to use.

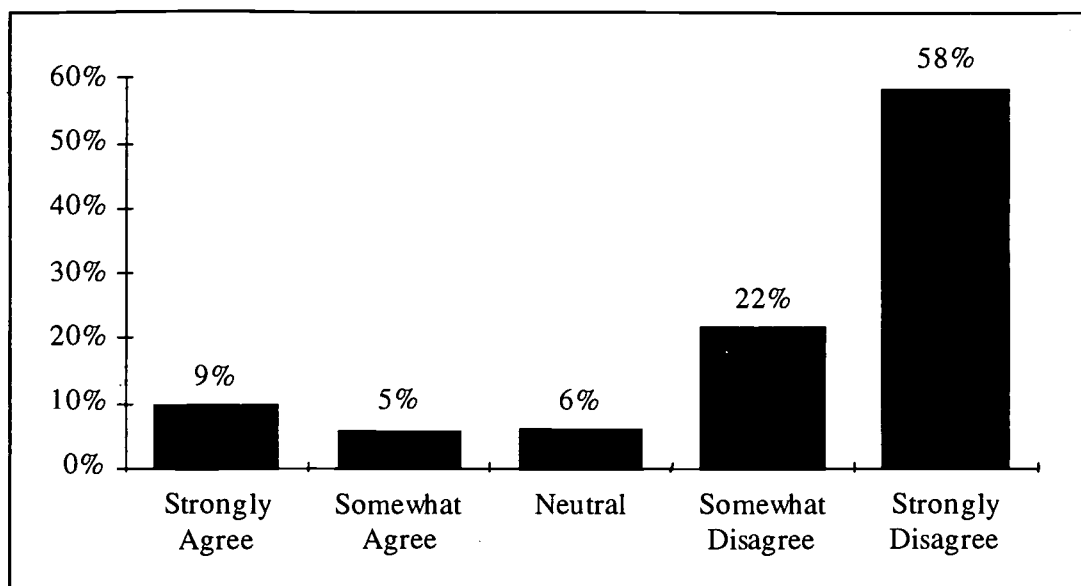


Figure 1: I feel uncomfortable using ECTs to ask for assistance on work I am doing.

Using ECTs for Obtaining Technical Information

Over 90% of respondents felt that they are able to get technical information quickly from co-workers using ECTs (see Figure 2).

We use e-mail with attachments of data (code, pictures, video, whatever) all the time to convey [technical] information.

On-line documentation and a combination of beepers, voice mail, and e-mail give me access to enormous amounts of information. Even more information is available using anonymous FTP and network news.

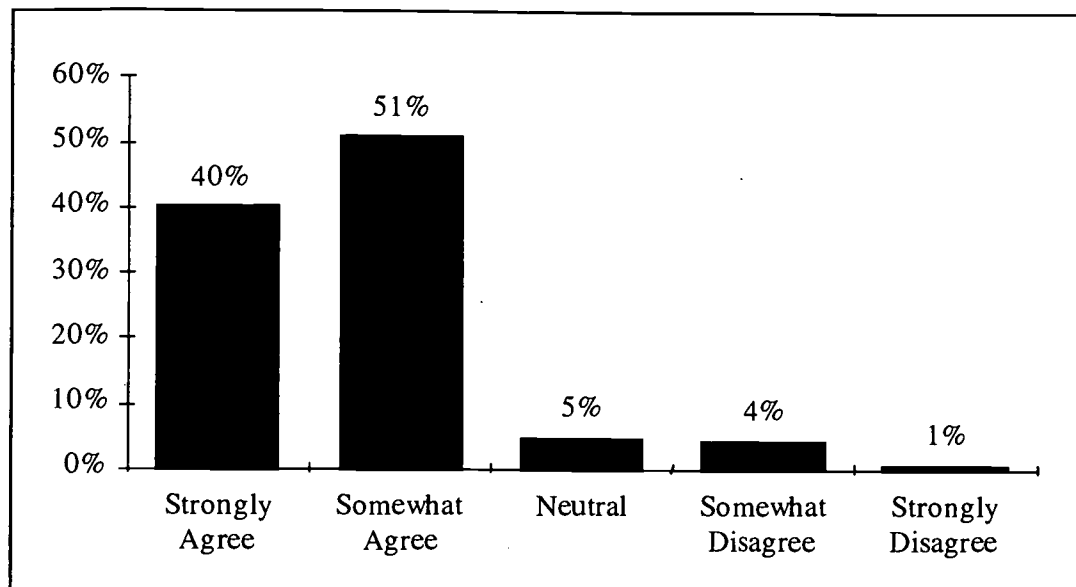


Figure 2: I am able to get technical information I need quickly from co-workers using a combination of ECTs.

Sometimes getting quick answers is a matter of asking the right question. As one employee stated:

The knowledge base at our company is enormous and everyone is plugged in. Getting an answer is as easy as knowing how to ask the question.

Other times, one needs to know the right person or an appropriate newsgroup to send the question to. A reply from the newsgroup may suggest a specific person to contact.

All it usually takes to get the appropriate piece of information is to send a request via e-mail to the right person. Then they point me to the on-line information, or reply via e-mail.

A posting to one of Sun's internal newsgroups asking for information almost always elicits a response giving some basics and the name of someone with more information.

Barriers To Getting Technical Information Using ECTs

The biggest problem seems to be that sometimes people know that the information exists but do not know how to find it or who to ask for it.

Main problem is not knowing whom to contact due to the lack of a "yellow pages" type directory. When I do know whom to e-mail, I often succeed in getting the technical information that I need.

This sentiment was echoed again and again.

Once I've found the right person, then I strongly agree [that I can get technical information quickly]. However, finding the right person is sometimes hard.

There are two key points here:

1) I *can* get what I need quickly via e-mail, voice mail, fax, FTP, or copy via automounter, but, 2) How do I know who knows what or what information is located where? ...information is readily available, *if* you know where to look.

It can be hard at times here at Sun to find where or from whom the information is available. Once I've determined where the information is located, then I often can retrieve it quickly.

One employee felt that ECTs were good for getting technical answers, the problem was in knowing what ECTs were available and which to use in which instance.

While lots of [electronic communication] methods are available, finding out about these is very haphazard. There is really no directory or reference that tells of the many options available and how to use [them].

Success in getting technical answers quickly had to do with how well the question is asked, whether it is sent to the right people/person, how quickly a respondent gets to the message and responds, and awareness of the ECTs that are available for use. Despite the problems, employees appear comfortable with the speed with which they can get technical information from others using ECTs.

Using ECTs for Obtaining Feedback

Nearly 90% of the respondents agreed that they can get helpful feedback in a timely fashion (see Figure 3).

Where else can someone ask several thousand engineers a question worldwide in one single message sent from an individual's workstation? Only those knowledgeable and willing to answer do so, the others are "bothered" with a few seconds of interruption and delete the message...

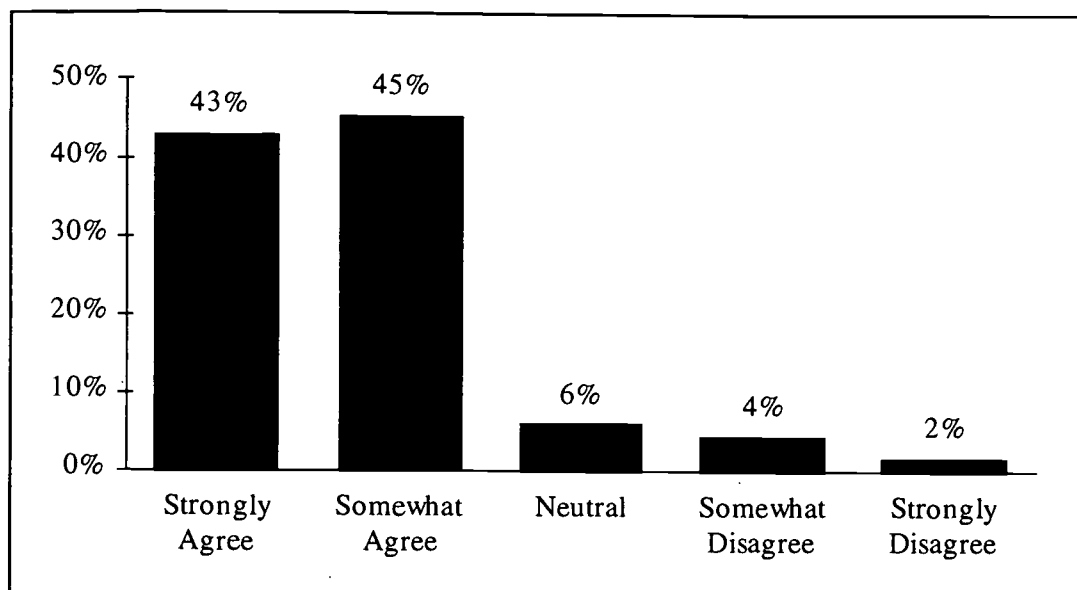


Figure 3: For solving work-related problems, I can get helpful feedback in a timely fashion using some combination of ECTs.

Barriers to Getting Timely Feedback Using ECTs

Others have given up on ECTs in the belief that they will not get an answer fast enough.

The problem is “timely.” Often I need to “manually” poll people for feedback since people are overwhelmed by e-mail.

E-mail traffic is so heavy now that it often takes days to get responses. People are also heavily booked in meetings, so the non-mobile phone is almost useless (except for tag). Filtering mechanisms are becoming requisite.

As with getting technical information, there are sometimes difficulties in getting help with work-related problems. Despite these problems, the majority of employees seemed to feel that they are able to get the answers they need in a timely manner.

Limitations to Communication Using ECTs—When a Face-to-Face is Necessary

Respondents discussed certain types of communications that were not handled well using ECTs. The most limiting aspect of electronic communication may be related to the lack of richness it provides. The multiple cues and the ease of back and forth communication provided by face-to-face communication appear to make it much easier to communicate about certain issues. The following attributes of the communication need influenced the decision to use a face-to-face:

- Complexity.
- Sensitivity.
- Consensus gathering.
- Potential for miscommunication.
- Timeliness.
- Characteristics of the particular group.

Complexity

For example, a face-to-face is necessary when:

something is hard to explain over the phone, or the person feels that he/she will explain things better if he/she comes over.

Sensitivity

If the communication is sensitive in nature, a face-to-face meeting would be necessary.

Issues that bring out our emotions (job fears, credibility, conflicts) are best held in person.

Face-to-face meetings are helpful for building commitment and working out conflicts.

Often face-to-face communication is imperative to resolve nasty problems.

Consensus Gathering/Problem Resolution

Face-to-face meetings are necessary when:

...we have to resolve some issues or problems quickly and we know it will involve a lot of discussions, drawing on the board, and some presentations, etc.

Final agreement on issues involve large group of people and there are more than one proposals and none of the proposals stand out as the winner.

...there is a big problem to be resolved. For day to day issues, we use e-mail/phone.

If I am doing “consensus gathering” (political or technical) I’ll repeat the same spiel to ten people personally; this is time consuming but extremely effective.

Potential for Miscommunication and Misunderstanding

It appears that the richness of face-to-face communication could reduce the chance for miscommunications and quickly clear up misunderstandings that can get perpetuated over e-mail. Many employees discussed this issue:

I learned early on that making controversial statements/judgments on e-mail is counter-productive. One message I sent took five minutes to compose and send. Because my message was somewhat negative in content, it took eight hours of meetings with many people to clarify what I said. Now I only deliver such messages in person so as not to waste time and to keep open communications channels.

E-mail is a dangerous medium because you do not have the nonverbal cues associated with a communication. This often leads to assumptions and occasional miscommunications.

Timeliness

Issues related to time were a common reason for needing face-to-face communication.

- For instance, if an issue has to be resolved immediately, employees do not use electronic communication. As one respondent put it:

A need for IMMEDIATE response also triggers a face-to-face. Electronic is not real-time. There is always a lag. You don’t get an e-mail request for help; you get someone sitting on your doorstep wanting you NOW!

- Others are concerned that with the tremendous amount of e-mail everyone is receiving their likelihood of getting a response, particularly a timely one, is low.

I have sent messages to people with the false assumption that they will read it; either it gets to them and they didn’t realize the significance enough to really read it or they don’t have time to process their e-mail frequently enough to have it be readable.

[A face-to-face provides] immediate results—no waiting for person to get back in e-mail—some folks have severe e-mail-overloads—you never get an answer.

Size and Composition of the Group

- Many respondents felt that when the group contained more than two members, meetings were more useful face-to-face.

- Others alluded to the importance of face-to-face contacts and knowing the members of one's group:

Face-to-face meetings are essential to maintain work relationships. Without a live face-to-face relationship I do not think electronic relationships work. Even though I communicate electronically, I am sub-consciously aware of the other person's personality. Sometimes face-to-face brings out quicker solutions.

It depends on whether I know the person or persons. If I don't know them, I feel a bit uncomfortable, and would prefer discussing things with them in person.

When Electronic Communication is Preferred

Many seemingly felt that electronic communication is less intrusive than face-to-face and because it is asynchronous, it is more convenient and may result in better, more thought-out answers.

Avoiding Interruptions

It is much simpler for me to get [assistance] on-line than to interrupt somebody's day to ask for information.

E-mail often works better than barging into someone's office. It's less intrusive and it allows the receiver more time to think.

E-mail and voice mail are very powerful and efficient ways of obtaining information and assistance. The ability to exchange messages "asynchronously" (i.e., no more "telephone tag") means everyone can make better use of their time.

ECT Versus Face-to-Face Communication for Giving Feedback

There was no clear preference for giving feedback using ECTs or face-to-face. The response was mixed on this issue with the greatest percentage (34%) of respondents choosing the "neutral" response category (see Figure 4). The rest were split about equally between using ECTs and using a face-to-face meeting for providing feedback. Employees with less than ten years of work experience were more likely than those with ten or more years work experience to provide feedback using ECTs.

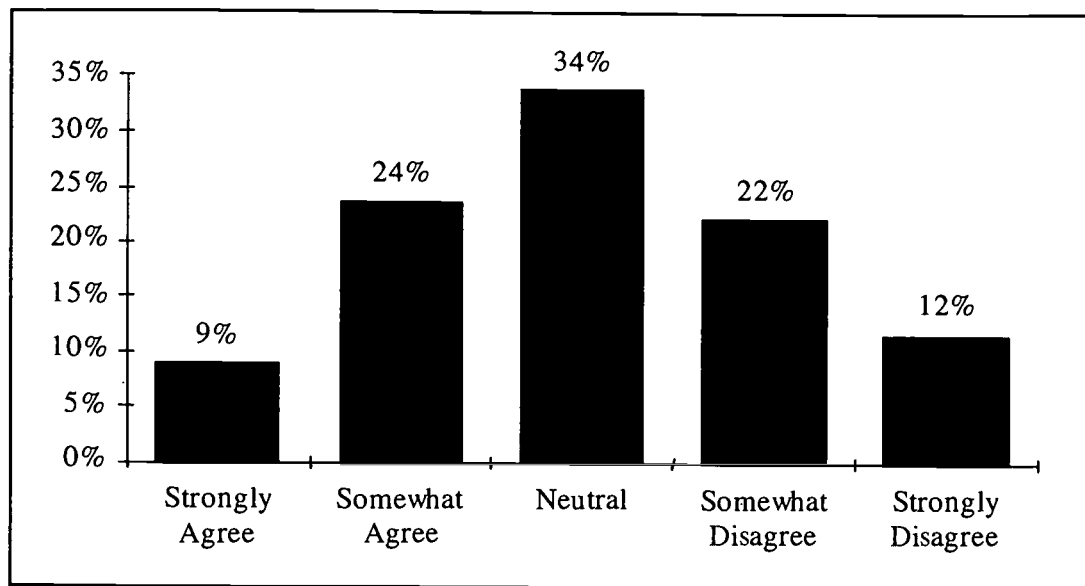


Figure 4: I am more likely to offer work-related feedback to a co-worker using ECTs than I am in a face-to-face meeting.

The Influence of Positive or Negative Feedback on Choice of Feedback Mechanism

Several respondents discussed the difference among types of feedback and their implications for choice of medium. For instance, choice of feedback mechanism may depend upon whether the feedback is positive or negative.

Positive feedback is easy to give, both in person and electronically. Negative feedback is usually best done in person. There's not enough personal context (body language and tone of voice, for instance) in electronic media to comfortably give negative feedback in a constructive way.

My choice of medium would depend in part upon the message. If the feedback were positive, I would be somewhat inclined to send the message electronically. If the message were negative, however, I would most likely choose a face-to-face meeting, which would enable me to respond immediately and unambiguously to questions or concerns. E-mail can be an ambiguous medium at times, so even for positive feedback, I'm usually inclined to choose a face-to-face meeting, where my body language and facial expressions can augment my message...

Putting things in writing doesn't always work, especially for sensitive subject areas. Depends on the nature of the response. I consider it impolite to say certain things, such as a strong criticism, over e-mail.

The Influence of Technical Detail on the Choice of Feedback Mechanism

At other times, choice of feedback mechanism may depend upon how extensive and involved the feedback is.

Some kinds of technical detail *need* to be written down; I consider it a courtesy to offer such detail in e-mail since it relieves the recipient of the need to transcribe. This also ensures that the details get written down *right*.

Feedback on documentation I do best by marking up the piece of paper. Feedback on a complex design proposal I do best by e-mail.

For feedback on technical issues, e-mail is the preferred method. The saved e-mail serves as a reminder of the issue, and there is an audit trail. For feedback on personal issues, e-mail is too cold and prone to misunderstanding.

As these quotes illustrate, there are numerous factors that influence which mode of communication employees will choose. Sometimes it is the type of feedback that dictates mode of response and other times it has more to do with factors related to the medium or a personal preference for electronic versus face-to-face contact. Although based on the particular circumstances, one mode of communication may be more preferred than another, most employees seemed to think that either ECTs or face-to-face communication will serve their purposes in most instances.

3. ECTs and Tasks/Project Stages

Respondents were asked for their agreement with the statement, "Electronic communication technologies are not very good for brainstorming about new ideas." A nearly equal percentage agreed that ECTs were not good for brainstorming as disagreed (see Figure 5).

As might be expected, comments reflected benefits/drawbacks of both methods.

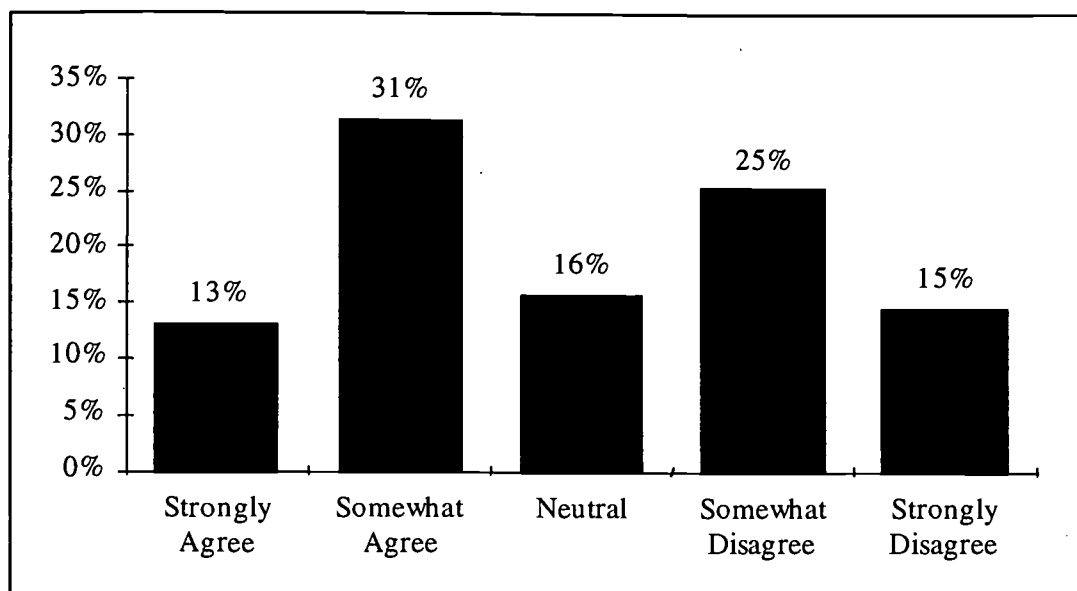


Figure 5: ECTs are not very good for brainstorming about new ideas.

Value of ECTs in Brainstorming/Idea Generation Activities

Many agreed that the electronic environment made it easier for everyone to participate and to come up with more innovative ideas. As one comment illustrates:

there isn't an opportunity to interrupt. Group members that normally would have a difficult time expressing their ideas may be able to participate more actively [using ECTs].

Another comment reflects the feeling that ECTs can be good for getting everyone's innovative ideas.

I tend to think that people are more likely to suggest a somewhat "innovative" (i.e., "off the wall") idea in an electronic forum, because (at least with e-mail/newsgroups) they can fully express their idea and any justifications it may have before somebody can say, "That won't work" or something.

Drawbacks of ECTs on Brainstorming/Idea Generation Activities

Many comments had to do with time issues.

For some design issues the pace of e-mail is better suited than face-to-face; it can take quite some time for radical technical ideas to "soak in" and in face-to-face something that in retrospect was revealed as promising might completely lose out in the quicker pace of face-to-face exchanges.

Others felt that electronic brainstorming sessions were too slow.

The communications media we currently have in place do not lend themselves to the speed/tempo of brainstorming. We get too caught up in the communications technology details and forget our valuable insights.

And others stated:

E-mail is good for brainstorming if you have a few weeks for people to mull over and discuss things. If you want to do brainstorming in a short-time, e-mail is bad. Ditto for project definition.

Anything more than a couple of sentences and your time can be used much more wisely by meeting face-to-face.

Many employees seemed to feel that using ECTs would diminish the necessary intensity of face-to-face brainstorming sessions.

Brainstorming, with an emphasis on “storming” requires a certain energy exchanged between human beings in the same location. One idea bouncing off the other, with immediate feedback triggering other interactions. Asynchronous brainstorming becomes a mere discussion as people lose track of ideas and misunderstand the intent.

I like to look at the faces of the people during brainstorming. The facial expressions help to keep the intensity high during the process.

Nothing will replace the “bullpen” meeting where individuals bounce ideas off each other. The zanier the better.

Some respondents seemed to take into account the benefits/drawbacks of each and suggested that a combination of ECT and face-to-face sessions might be the best situation.

Responses/ideas tend to be better thought out and presented [using ECTs] than in a meeting, but the lack of focus slows everything down intolerably, and destroys the dynamism of face-to-face exchanges. Best would be a short face-to-face meeting followed by e-mail deliberation, followed by a face-to-face wrap-up.

Use of ECTs for Scheduling/Coordination/Implementation Activities

In general, most respondents seemed to feel that e-mail was especially useful during the middle project stages, including: technical and administrative implementation tasks and project management (see Figure 6). Just slightly more than 40% felt it was useful for project definition, start-up and conclusion. About 25% felt that e-mail was good for brainstorming and project review, and only 10% felt it was good for team building.

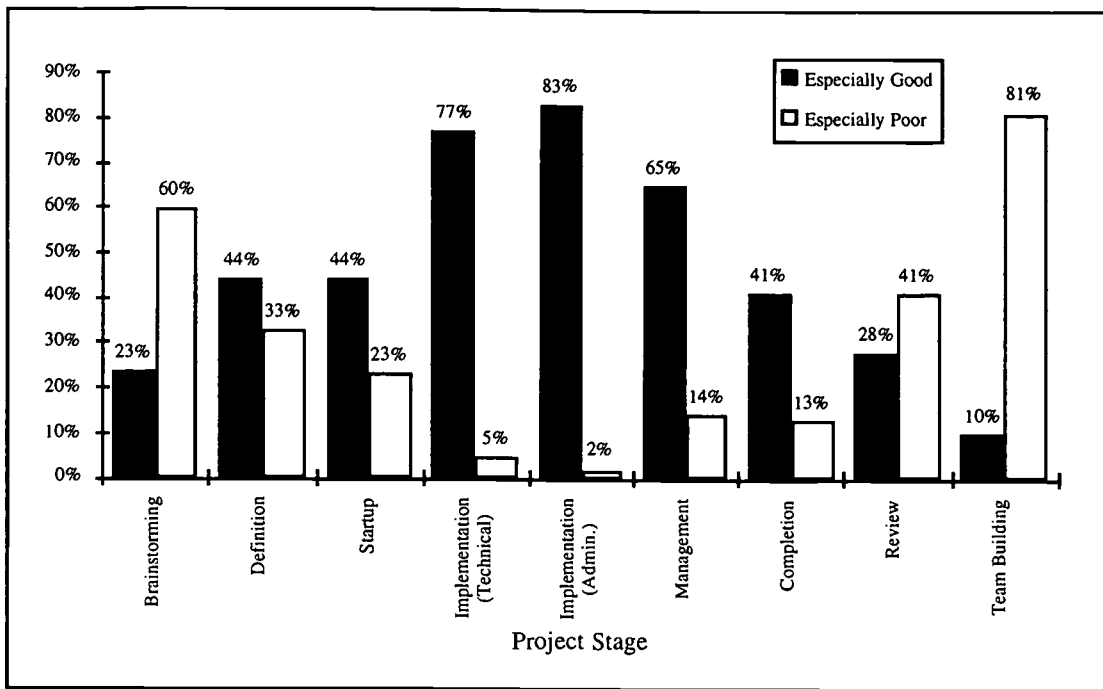


Figure 6: Project stages for which e-mail is especially good or poor.

One comment reflects these overall findings well.

For the first three [brainstorming, definition, and start-up] e-mail *must* be mixed with face-to-face. For the next four [technical and administrative implementation, management, and completion] which are primarily bureaucratic in intention, e-mail alone is *best*... The last two [review and team building] are highly interactive (like number one, brainstorming) and *need* face-to-face. Here the best role for e-mail is circulating minutes or drafts.

Some people discussed the usefulness of e-mail in relation to specific tasks. In relation to brainstorming, one employee commented, "I think brainstorming is more productive if set up with an initial position-exchange via e-mail."

And one felt that technical implementation communications are

best on e-mail because people have time to read and understand, whereas in a face-to-face meeting, it can be hard to cover the ramifications of all technical issues.

ECTs, and especially e-mail, are particularly good for coordinating and planning activities and bringing everyone up to speed.

All minutes from meetings are distributed [using ECTs].

Coordination functions of ECTs include both planning something in terms of time and place for a meeting, as well as agreeing on the issues and planning agendas ahead of time.

E-mail is good for: 1) forwarding interesting information to co-workers and friends, 2) making connections between people usually by forwarding mail, 3) making appointments, and 4) finding the right person to talk to about something.

[ECTs] are good when there are details—time and place to meet, that kind of thing. Voice mail I like when I'm confirming someone else's plans or when I know they're busy, but want to talk to them later.

E-mail is also useful for generating automatic messages or reminders.

I can use my computer to generate messages that need to go out on a regular basis without my having to remember to do it each time.

A number of respondents felt that the “trail” left by e-mail is useful. For example, “E-mail also gives one a record of discussions, which can be very handy.” And, “[e-mail is good when I] need a hard copy for later reference or need to send information to a number of people.”

Many respondents felt that e-mail is useful throughout all the stages of a project.

I think [e-mail] is an essential communication option for all the categories. It may have greater utility in some, but I would consider it indispensable in all cases.

E-mail can be effective at all stages of a project. It depends on what the scope of the topic is, the urgency of the communication, the kinds of decisions to be made.

Most agreed that e-mail is especially useful for technical and administrative communications and also for project management. Assessments of its usefulness were mixed for all other stages. However, many commented that e-mail and other ECTs are actually useful throughout the process and the usefulness is tied more to the particular communication need than to the particular project stage.

4. ECTs and Face-to-Face Communication

ECTs are the primary form of communication for most respondents. As shown in Figure 7, 37% of respondents use ECTs in their interactions with co-workers 61 to 80% of the time and another 13% use them 81 to 100% of the time.

Some days, after work, I tell my friends that I had a “no human interaction” day. While rare, at times I'll go an entire workday without talking to anybody face-to-face.

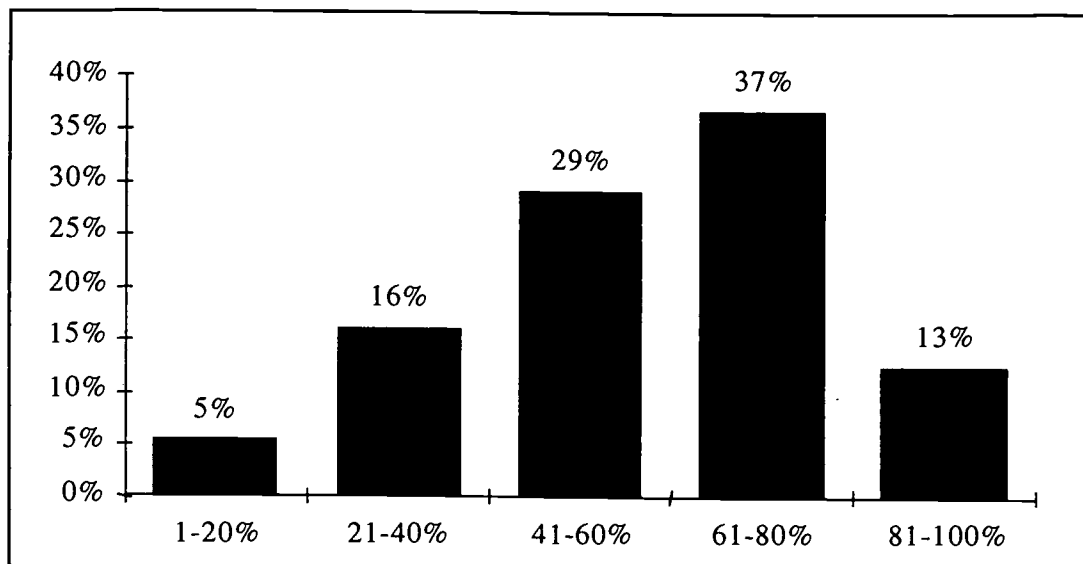


Figure 7: Percentage of daily communication via ECTs.

Does Regular Use of ECTs Make Face-to-Face Communication Less Important?

Most (72%) still consider face-to-face meetings an integral aspect of working with others with whom they regularly communicate using ECTs. Another 21% consider them a complement to effective communication (see Figure 8).

We use [ECTs] for discussing product development issues. This ranges from complex software implementation details to design discussions to announcements of meetings to jokes/humor/gossip. If you imagine that the bunch of us worked all day every day in the same (large) office, this is the equivalent of the office conversations we'd have. This has worked very well for us, but it has not at all replaced the need for meetings and face-to-face interactions.

Clearly, these ECT users have not turned away from face-to-face interaction. Most felt that face-to-face interaction is very important to their work communication process: particularly if they are working on complex issues, if they haven't met face-to-face before, or if the particular group situation just seems to require it.

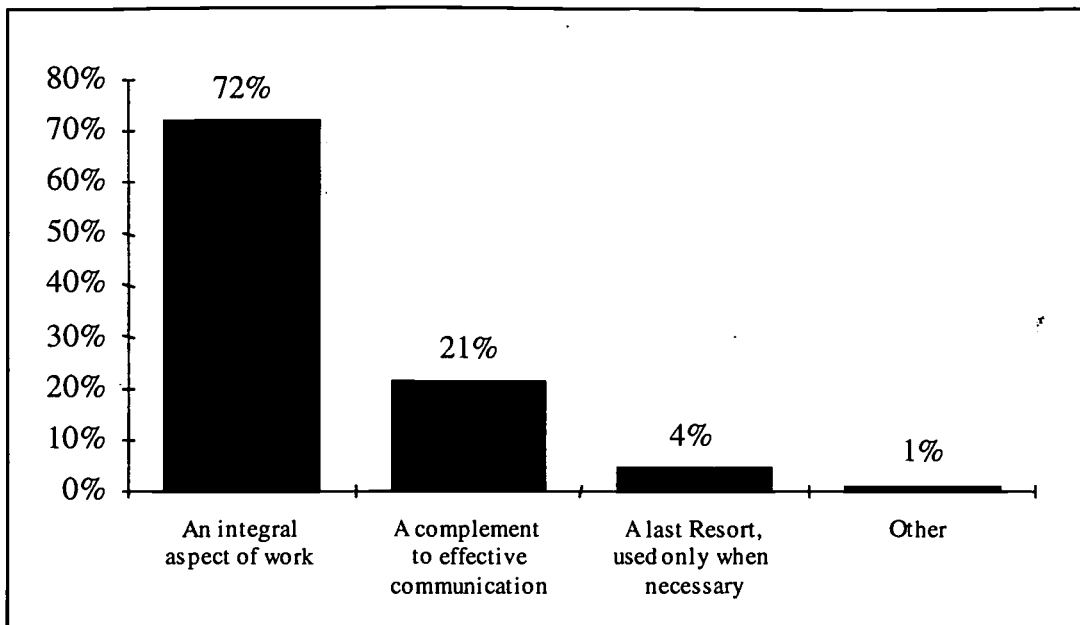


Figure 8: Which of the following best describes how you view face-to-face meetings with co-workers with whom you regularly communicate via ECTs?

Does Regular Use of ECTs Reduce the Amount of Face-to-Face Communication?

- In some ways, the use of ECTs has increased the amount of face-to-face contact the employees engage in. As one person stated, “Using the technologies increases my social links, without them I would probably not have face-to-face contact.”
- However, as another employee commented, “...at times it does reduce the face-to-face contact, and if you are not careful it can have a negative effect...but mostly it is a more convenient means of communicating one-on-one.”

Most seemed to feel that using ECTs had little to no effect on the amount of face-to-face contact they have. As one person put it, “I don’t think any of the electronic media have any impact on how much face-to-face contact I have...e-mail in particular, and voice mail to a lesser degree, just make more interaction possible.”

Does Regular Use of ECTs Focus Face-to-Face Meetings?

Employees were asked whether face-to-face meetings with co-workers with whom they had been regularly communicating via ECTs were more focused, about the same, or less focused as meetings with people whom they communicated with infrequently using ECTs. Over 40% of the

respondents felt that face-to-face meetings with those whom they had been regularly communicating using ECTs were more focused, another third thought they were about the same, and 20% thought they were less focused (see Figure 9).

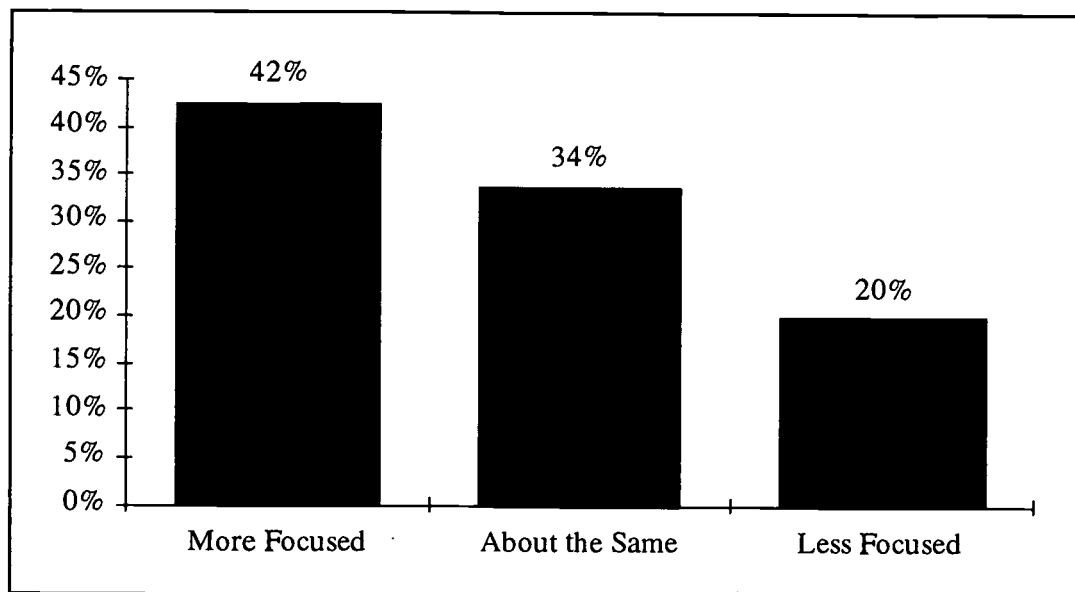


Figure 9: When you meet with co-workers with whom you regularly communicate via ECTs, are the face-to-face meetings more focused, about the same, or less focused than with co-workers with whom you infrequently communicate via ECTs?

Aspects Which Make Face-to-Face Meetings More Focused

Those who felt face-to-face meetings were more focused tended to think that by communicating regularly using ECTs everyone was already familiar with the issues and much could be worked out ahead of time. A couple of comments are illustrative:

Of course they are more focused because you have already had several “discussions” and should be able to move from there. You have already established a context for your discussions.

After also exchanging e-mails on the subject, people attending the face-to-face meeting are familiar with the issues involved. There is little time wasted bringing someone up to speed on the problem.

Not only are participants able to work things out ahead of time, they are able to identify which issues require a more in-depth focus and plan to deal with these when they get together face-to-face.

Since ongoing communication occurs more often via electronic interactions, we don't have to mess with the details as much. We can focus on more strategic issues.

...maybe more focused because we save only the most difficult or most pressing issues for the face-to-face meeting.

Many issues tend to be resolved through e-mail, when we meet face-to-face we need only discuss those things which are important to discuss, we don't have to spend time glossing over the other issues.

Aspects Which Make Face-to-Face Meetings Less Focused

However, not everyone agreed with this assessment. Some felt that face-to-face sessions were less focused because people know each other from communicating electronically and getting together gives them a chance to actually "talk" to each other.

[Face-to-face meetings are] more wide ranging, since I "know" the people already on-line, and I know that I can always follow up on tasks via e-mail.

In a face-to-face meeting with someone in my group, I'll often ask a general, social question like "So, how's it going?" or "How was your weekend?"

The Case for No Difference in Meeting Focus Based Upon Previous Electronic Communication

Others felt that the degree of focus in a face-to-face meeting had little to do with whether the group had been communicating electronically. There is just something about getting people together face-to-face that results in discussions of far-ranging topics.

I'd say any meeting where you meet face-to-face is going to be less focused, go off on tangents. I don't feel the amount of communication has much to do with it. I have found that getting together face-to-face, other issues/questions arise because during the discussion someone may say something that triggers a thought you had forgotten about.

E-mail gets right to the point, whereas face-to-face meetings tend to get into "rat holes" of unrelated discussions ranging from other work issues to discussions of more personal non-work related issues. Face-to-face meetings tend to burn up valuable time...

Overall, the greatest percentage of respondents felt that face-to-face meetings were more focused as a result of communicating electronically. They felt this way because a context for the meeting could be laid out ahead of time and they could decide which issues were going to require the in-depth focus of a face-to-face contact. The smallest percentage felt that the face-to-face meetings were less focused. These people tended to believe that when getting together with those they have

been communicating with, they finally have the chance to catch up on each others' lives and gossip.

5. *ECTs and Social Relations*

Getting to Know Others

Many respondents reported that the use of e-mail, in particular, was a great way to get to know others with similar interests.

Using e-mail allows me to develop better relations with people that I may work with now or may work with eventually, e.g., last week an administrator that I am working with on a joint meeting posted a request for information on eye surgery. She and I have never met face-to-face, but I had some data to share with her. Connecting in this way has given me a positive sense of anticipation of enjoying our future working relationship. We have shared something personal, and that creates a sense of community. She also knows that I am a responsive person, not someone who will ignore her communication.

I even started one relationship (that lasted about two years) over e-mail and pursued another relationship with someone at another company using e-mail. In many ways, it's a lot easier to be witty and/or courageous over e-mail than in person...

One employee differentiated between newsgroups and e-mail.

Generally, social relations may have their beginning on a newsgroup, but I generally move to e-mail after initial contact is established. I have met two very good friends this way in the past two years by reading special-interest newsgroups.

Thus, in some ways, developing relationships may be easier using ECTs than face-to-face. By joining newsgroups made up of people with similar interests, connections are made with others who one might never have met otherwise.

Maintaining Connectivity

What about maintaining relationships and social connectivity with others in the organization? ECTs appear useful for maintaining connections:

In general, I find the ability to send e-mail a great asset in my social life...In fact, it is frustrating that older and closer friends may not have e-mail—I feel that communicating with them is more difficult.

I use e-mail and voice mail heavily to maintain social contact. There are many times when I want to pass on information, set up a social engagement, just touch base and say, "Hi, how are you?" but don't want to get tied up in a real conversation.

E-mail is the best tool ever invented for both social and business contacts; I would hate to live without it. I have been using e-mail since 1978, and I felt isolated when I did not have access to it for a couple of years in the late '80s.

Communicating in this way allows employees to interact and have discussions on far-ranging topics with anyone else who is interested.

I do participate in an informal chat alias of employees. It provides an outlet to let off steam once in awhile. It also is a source for humor and gossip. All of us participate in discussions as time permits...

I use e-mail all the time to maintain social contacts within Sun (and sometimes with those who have been at Sun and who leave, but provide me with a network address outside Sun). I talk sports with some friends who are in "distant" locations (in another building in other words), I talk food (and arrange for lunch get-togethers) with others, and I am on some small social aliases which get going on any number of subjects, depending on what is going on in the news or within Sun or on any subject that just strikes one of us as interesting.

We have a person we work with who sends out a joke-of-the-day. It started inside Sun but is now sent to people all over the world...It is a real team builder and a little heartbeat that says every day that you are still connected and the world is fine 'cause the joke arrived.

Overall, ECTs do seem to provide the means for making connections with others in the organization and in some ways may be better suited to this function than face-to-face contacts.

Summary of Findings

Overall, the value of ECTs appear to be limited for certain types of communications. These include discussions on complex and sensitive issues. They are insufficient for team building, consensus building, and conflict resolution. Most agreed that relying on ECTs for communication increased the likelihood of miscommunications and loss of privacy. Respondents saw ECTs as a less immediate form of communication and this has become more true with the constant increase in the number of messages people are trying to deal with. Group work can sometimes be limited by ECTs, depending upon the group's size and expertise in communicating electronically. Some just feel the need for face-to-face communication. At the same time, many respondents reported that ECTs, especially e-mail, helped them meet new people at Sun and develop and maintain social relationships.

Conclusions

The goal of this study was to understand the role of ECTs in maintaining work-related communication. Sun Microsystems, a company that is highly advanced in the use of electronic communication, was chosen as the study site. By focusing on a company that has been using ECTs for some time, better insight could be gained as to how electronic communication actually works for an organization on an ongoing basis. Although this study was descriptive and based on a single company at one point in time, it does offer insights into the role ECTs can play in organizations in which communication among co-workers who are physically separate from each other is critical to the success of the firm.

Organizational Learning and Communities-of-Practice

Most of the respondents at Sun use ECTs for the vast majority of their workplace communications. ECTs work well for the bulk of employees' everyday communication needs. There are certain characteristics of electronic communication which make it particularly useful. For example, the employees felt that there is a wealth of knowledge residing among their co-workers, and the use of e-mail allows them access to this information in a way that would be impossible if limited to face-to-face communication. Employees can send messages to entire groups of users with the expectation that someone will have an answer, or they can inquire of a particular co-worker who is located across the campus, the city, or the world from them. This convenience of ECTs was particularly appreciated. The asynchrony of this kind of communication allows users to communicate with one another when the time is best for them rather than needing to interrupt each other every time there is a question.

One of the aspects of a "community of practice" is that individuals feel comfortable asking questions and giving feedback and other information to their work colleagues. At Sun, most employees were quite comfortable using ECTs to ask for assistance and to give (especially positive) feedback. There are several qualifications to this, however. Although the vast majority felt that they were able to get technical information as well as helpful feedback in solving work-related problems quickly from their co-workers using ECTs, their comments revealed limitations in the use of ECTs. These centered around timeliness of responses, sensitivity and complexity of the communication, group size and familiarity.

Age and Gender

Beyond those instances when face-to-face communication was considered more appropriate than electronic communication, it was of interest to explore the barriers (real or perceived) that were

raised in reference to electronic communication. Are certain user groups less comfortable than others with the use of ECTs? Somewhat surprisingly, we found that neither age nor gender had a significant effect on our findings, with just one exception. Those who had been working for less than ten years were more likely to offer feedback using ECTs than those with ten or more years of experience. However, there were no other differences in comfort with or use of ECTs as a function of age or gender.

ECTs and Face-to-Face Communication

Most employees count on face-to-face meetings to “round out” their communication needs. ECTs are not ideal for every situation. They find that there are times when electronic communication is either too limited or simply inappropriate for their needs. Daft and Lengel (1984) proposed that face-to-face communication provides—to a greater degree than electronic—the availability of instant feedback, transmittal of multiple cues, use of natural language, and a personal focus. Sun employees appear to agree. For example, when they want to convey complicated or sensitive information, they feel it is best done in a face-to-face meeting. When groups must resolve issues and/or come to agreement, face-to-face communication is deemed necessary. This finding supports previous research which has found that face-to-face groups come to agreement faster and easier than those communicating electronically (Kiesler et al., 1984; Olaniran, 1991; Sproull & Kiesler, 1991; Weimer, 1988).

When possible, face-to-face communication is utilized by Sun employees when time is an issue. To get something resolved immediately, face-to-face communication is preferred because there is always lag-time with ECTs. This is becoming especially true as electronic messages continue to pile up.

Sun employees expressed mixed feelings as to whether face-to-face meetings were more or less focused as a result of regular electronic communication. Those who thought that meetings are now more focused felt that by communicating electronically, everyone becomes aware of the issues and those which are sufficiently complicated that they must be resolved in a face-to-face meeting can be identified. Others felt that getting together in person allows employees to chit-chat, gossip and go off on tangents. Some seemed to think that this tendency for less focused discussions is exacerbated by already “knowing” each other electronically and others felt that this is characteristic of any face-to-face meeting. Perhaps, by communicating electronically, groups are able to resolve issues ahead of time and have more focused face-to-face meetings as a result. But, if the particular members of the group are interested in chatting when they get together, the gains made by resolving issues ahead of time may be lost.

ECT doubters are concerned that those communicating electronically will never be seen again. There was no agreement across Sun employees as to whether the amount of face-to-face contact they had with others at Sun has declined as a result of their use of electronic communications. Some felt that the use of ECTs increased their face-to-face contact, others felt that it decreased their contact, but probably the greatest number felt there was no change in the amount of face-to-face contact they have. There remain times when people feel they must meet face-to-face. For many, what seems to happen with the use of ECTs is, as one person commented, more interaction with more co-workers.

Stage in the Project Process

Sun employees found that some tasks were best handled using ECTs, others required face-to-face contacts, and still others could be handled either way depending upon the circumstances. Past research has suggested that more ideas are produced when brainstorming using ECTs (Hollingshead et al., 1993; Olaniran, 1991; Valacich et al., 1994). It may be that people find it easier to brainstorm electronically because they are less inhibited and the traditional status dominance that occurs in face-to-face conditions is reduced (Kiesler et al., 1984; Sproull & Kiesler, 1991; Zimmerman & West, 1975). Some employees' comments reflected these findings, stating that members who would normally have a difficult time participating were able to "voice" their ideas electronically and that the ideas generated were more innovative in the electronic forum. However, many employees felt that brainstorming was best done face-to-face because of the group dynamics and "energy" created by physically being together. Finally, some felt that the ideal situation for brainstorming, as well as for a variety of tasks, was a mix of electronic and face-to-face communications, such that the ECT could be used to define the issues and arrange meeting times while face-to-face meetings could be used for dynamic processes such as coming to final agreement.

Employees consider e-mail to be particularly useful for technical and administrative communications and project management components of projects. They don't like e-mail for the beginning and ending stages of projects where consensus is necessary for defining project goals and coming to final agreement. Hence, the middle stages and administrative functions that occur throughout projects seem best suited to the use of e-mail.

Protocols and Directories

One barrier to the successful use of ECTs at Sun was in becoming familiar with all the mechanisms that are available for communicating electronically, learning which are best for which situations, and finding out how best to use them. Another problem had to do with the lack of some sort of

resource directory to help people figure out who to contact for particular questions. One employee suggested a “yellow pages” type directory to help in figuring out who to contact.

Another problem is the ever-increasing amount of communications that people are receiving. It is becoming more and more time consuming to go through all of one’s electronic messages and mail and figure out which are important and which need to be responded to. Another employee felt that the lack of good tools to help people defer responding without forgetting to respond was a real barrier to electronic communications. One study which examined the usefulness of computer-mediated communication for ongoing management groups proposed some suggestions that might help others who are trying to facilitate electronic communication:

- Communication mode options should be explicitly evaluated by the group and an adequate range of those options made available to the group.
- Computer-mediated communication systems should be designed to be easy, convenient, and reliable enough so as not to compromise making appropriate mode choices.
- Managers should explicitly consider their choice of a communication mode based on its fit to the particular circumstances surrounding the communication.
- Group work should be spatially and temporally configured so that face-to-face communication can occur easily and efficiently when needed.
- The group should explicitly discuss its communication habits and practices.
- Groups should establish and maintain group commitment to open, honest, and clear exchange of information in support of the group’s goal, so that appropriate modes of communication will be chosen and effective communication realized (Zack, 1991).

Social Connections

Sun employees appear to have little trouble meeting others in their organization using ECTs. In fact, in some ways developing relationships may be easier using ECTs than face-to-face. One can join newsgroups and meet others who have similar interests. This way, people can make connections with others they might otherwise have never met. Further, those who are shy or uncomfortable meeting others face-to-face may benefit by being able to “meet” people for the first time in the more “safe” electronic medium where inhibitions are reduced (Kiesler et al., 1984).

Brown and Duguid (1991) and Lave and Wenger (1990) propose that organizational learning involves becoming an “insider” to the organization. They state that one must learn to interact with the informal community and share stories with it in order to learn their jobs and fully understand and participate in the corporate culture. However, it may be that when the necessary learning is electronic in nature, ECTs are actually a more appropriate environment for this learning to take place. In the case of Sun employees who are comfortable asking questions electronically and feel that they get timely feedback on their questions, this may be the case.

Overall, it is apparent that ECTs can play a critical role in timely and effective office communications. However, they function more as a complement than a substitute for face-to-face communication. Electronic communication is the preferred method for the bulk of everyday communications, but face-to-face communication is preferred when the communication is particularly in-depth, personal, or (in cases where immediate face-to-face access to the other is possible) limited by time. Like the conclusions made by Zack (1991) in reference to groups working together using electronic mail, it is important to make ECT users aware of the different modes of communication available to them and to train them in the most effective ways to make use of the various modes. In addition, managers must understand that ECTs will not always be the best mode of communication, and face-to-face meetings should remain an option. In this way, employees will be able to make informed choices about which mode of communication best suits their needs in each individual situation.

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Appendix:
**Workplace Survey on Use of
Information Technology for Remote Communication**

WORKPLACE SURVEY ON USE OF INFORMATION TECHNOLOGY FOR REMOTE COMMUNICATION

Sun is participating in a study with the Cornell University International Workplace Studies Program looking at how engineers use electronic communication technology (voice communication technology: telephone, video conference, etc., and data communication technology: fax, direct e-mail, internal business aliases, internal social aliases, rlogin, cross-machine interface, FTP, mosaic, etc.) in their work and how it influences the nature of the face-to-face communication they have within Sun. Please fill out the 16 question survey at the end of this message and return to me. We expect that the results of this survey will help us better understand how electronic communication at Sun affects the way we work, and therefore, how we might work more effectively. All responses will be kept anonymous and confidential.

Thanks very much for your help,

Kathy Schmidt, Sun Properties

1. I am able to get technical information I need quickly from co-workers at SUN using a combination of electronic communication technologies.

- a) Strongly Agree
- b) Somewhat Agree
- c) Neutral
- d) Somewhat Disagree
- e) Strongly Disagree

Comments/Example/Anecdote that help explain why you answered the way you did.

2. For solving work-related problems, I can get helpful feedback in a timely fashion using some combination of electronic communication technologies.

- a) Strongly Agree
- b) Somewhat Agree
- c) Neutral
- d) Somewhat Disagree
- e) Strongly Disagree

Comments/Example/Anecdote that help explain why you answered the way you did.

3. I feel uncomfortable using electronic communication technologies to ask for assistance on work I am doing.

- a) Strongly Agree
- b) Somewhat Agree
- c) Neutral
- d) Somewhat Disagree
- e) Strongly Disagree

Comments/Example/Anecdote that help explain why you answered the way you did.

4. Electronic communication technologies are not very good for brainstorming about new ideas.

- a) Strongly Agree
- b) Somewhat Agree
- c) Neutral
- d) Somewhat Disagree
- e) Strongly Disagree

Comments/Example/Anecdote that help explain why you answered the way you did.

5. I am more likely to offer work-related feedback to someone else at Sun using electronic communication technologies than I am in a face-to-face meeting.

- a) Strongly Agree
- b) Somewhat Agree
- c) Neutral
- d) Somewhat Disagree
- e) Strongly Disagree

Comments/Example/Anecdote that help explain why you answered the way you did.

6. What usually prompts a face-to-face meeting between yourself and one or more of those co-workers at Sun you regularly communicate with via electronic communication technology?

Comments/Example/Anecdote that help explain why you answered the way you did.

7. When you do meet face-to-face with other people at Sun you regularly communicate with via electronic communication technology, are the face-to-face meetings:

- a) More focused (task-oriented) than meetings with people you infrequently communicate with via electronic communication technology.
- b) About the same as any face-to-face meeting you have with other people at Sun whom you infrequently communicate with via electronic communication technology.
- c) Less focused, more wide-ranging discussions than with other people at Sun whom you infrequently communicate with via electronic communication technology.

Comments/Example/Anecdote that help explain why you answered the way you did.

8. Which of the following best describes how you view face-to-face meetings with other people at Sun with whom you regularly communicate via electronic communication technology:

- a) An integral aspect of working with others with whom you regularly communicate via electronic communication technology.
- b) A complement (nice but not essential) to effective communication via electronic communication technology.
- c) A last resort, used only when absolutely necessary.
- d) Other (please explain).

Comments/Example/Anecdote that help explain why you answered the way you did.

9. What factors influence your decision to communicate with a co-worker via electronic communication technology versus face-to-face communication. Please illustrate your response with recent examples of your own communication choices.

10. On an average work day, approximately what percentage of your overall interaction with co-workers is accomplished through electronic communication technology versus face-to-face communication?

% electronic communication technology

- a) 1-20%
- b) 21-40%
- c) 41-60%
- d) 61-80%
- e) 81-100%

Comments/Example/Anecdote that help explain why you answered the way you did.

11. For which stages of a project is e-mail especially good?

- Project brainstorming (generating/exploring new ideas)
- Project definition (setting goals, directions, scope, time, etc.)
- Project startup (project planning, beginning tasks, etc.)
- Project implementation (technical communications)
- Project implementation (administrative communications)
- Project management (checkpoints, progress reviews, quality, etc.)
- Project completion (communicating, “productizing”, etc.)
- Project review (post-mortem, assessment, etc.)
- Project team building (interpersonal relationships, issues settlement, dealing with conflict, etc.)

Comments/Example/Anecdote that help explain why you answered the way you did.

12. For which stages of a project is e-mail especially poor?

- Project brainstorming (generating/exploring new ideas)
- Project definition (setting goals, directions, scope, time, etc.)
- Project startup (project planning, beginning tasks, etc.)
- Project implementation (technical communications)
- Project implementation (administrative communications)
- Project management (checkpoints, progress reviews, quality, etc.)
- Project completion (communicating, “productizing”, etc.)
- Project review (post-mortem, assessment, etc.)
- Project team building (interpersonal relationships, issues settlement, dealing with conflict, etc.)

Comments/Example/Anecdote that help explain why you answered the way you did.

13. Please describe yourself:

Gender:

- a) Male
- b) Female

14. Please describe yourself::

Age Group

- a) 20-29
- b) 30-39
- c) 40-49
- d) 50+

15. Please describe yourself:

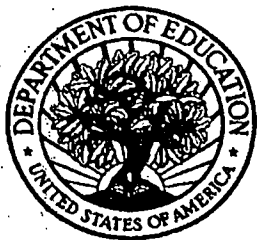
Years employed full time (including years at other companies, years self-employed, and years at Sun)

- a) < 1 year
- b) 1-2 years
- c) 3-5 years
- d) 6-10 years
- e) 11-15 years
- f) 16-20 years
- g) 21+ years

16. Please describe yourself:

Job group:

- a) Administrator
- b) Software Engineer
- c) Hardware Engineer
- d) EIS or Systems Engineer
- e) Professional Staff (Marketing, Human Resources, Finance)
- f) Sales
- g) Other (please specify)



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